

Family	Cytokine (alternative names)	Size (no. of amino acids) and form	Receptors (c denotes common subunit)	Producer cells	Actions	Effect of cytokine or receptor knock-out (where known)
TNF family	TNF- $\alpha$ (cachectin)	157, trimers	p55, p75 CD120a, CD120b	Macrophages, natural killer cells	Local inflammation, endothelial activation	Receptor: resistance to septic shock, susceptibility to <i>Listeria</i>
	TNF- $\beta$ (lymphotoxin, LT, LT- $\alpha$ )	171, trimers	p55, p75 CD120a, CD120b	T cells, B cells	Killing, endothelial activation	Absent lymph nodes, increased antibody
	LT- $\beta$	Transmembrane, trimerizes with TNF- $\beta$		T cells, B cells	Unknown	
	CD40 ligand (CD40-L)	Trimers	CD40	T cells, mast cells	B-cell activation, class switching	Poor antibody response, no class switch
	Fas ligand	Trimers	CD95 (Fas)	T cells, stroma?	Apoptosis, Ca <sup>2+</sup> -independent cytotoxicity	Lymphoproliferation
	CD27 ligand	Trimers (?)	CD27	T cells	Stimulates T-cell proliferation	
	CD30 ligand	Trimers (?)	CD30	T cells	Stimulates T- and B- cell proliferation	
	4-1BBL	Trimers (?)	4-1BB	T cells	Co-stimulates T- and B- cells	
Chemokines	IL-8 (NAP-1)	69–79, dimers	CDw128	Macrophages, others	Chemotactic for neutrophils, T cells	
	MCP-1 (MCAF)	76, monomer(?)		Macrophages, others	Chemotactic for monocytes	
	MIP-1 $\alpha$	66, monomer (?)		Macrophages, others	Chemoattractant for monocytes, T cells, eosinophils	
	MIP-1 $\beta$	66, monomer (?)		T cells, B cells, monocytes	Chemoattractant for monocytes, T cells	
	RANTES	66, monomer (?)		T cells, platelets	Chemoattractant for monocytes, T cells, eosinophils	
Unassigned	TGF- $\beta$	112, homo- and heterotrimers		Chondrocytes, monocytes, T cells	Inhibits cell growth, anti-inflammatory	
	IL-1 $\alpha$	159, monomer	CDw121a	Macrophages, epithelial cells	Fever, T-cell activation, macrophage activation	
	IL-1 $\beta$	153, monomer	CDw121a	Macrophages, epithelial cells	Fever, T-cell activation, macrophage activation	
	IL-1 RA	? monomer		Macrophages	Binds to but doesn't trigger IL-1 receptor, acts as a natural antagonist of IL-1 function	
	IL-10 (cytokine synthesis inhibitor F)	160, homodimer		T cells, macrophages, Epstein-Barr virus	Potent suppressant of macrophage functions	
	IL-12 (natural killer cell stimulatory factor)	197 and 306, heterodimer		B cells, macrophages	Activates natural killer cells, induces CD4 T cell differentiation to T <sub>H</sub> 1-like cells	
	MIF	115, monomer		T cells, others	Inhibits macrophage migration	

## Appendix II. Cytokines and their receptors

Family	Cytokine (alternative names)	Size (no. of amino acids) and form*	Receptors (c denotes common subunit)	Producer cells	Actions	Effect of cytokine or receptor knock-out (where known)
Hematopoietins* (four-helix bundles)	Epo (erythropoietin)	165, monomer*	EpoR	Kidney	Stimulates erythroid progenitors	
	IL-2 (T-cell growth factor)	133, monomer	CD25 ( $\alpha$ ), CD122 ( $\beta$ ), $\gamma_c$	T cells	T-cell proliferation	IL-2: decreased T-cell proliferation; Receptor $\gamma$ chain: incomplete T-cell development
	IL-3 (multicolony CSF)	133, monomer	CD123, $\beta_c$	T cells, thymic epithelial cells	Synergistic action in early hematopoiesis	
	IL-4 (BCGF-1, BSF-1)	129, monomer	CD124, $\gamma_c$	T cells, mast cells	B-cell activation, IgE switch	Decreased IgE synthesis
	IL-5 (BCGF-2)	115, homodimer	CD125, $\beta_c$	T cells, mast cells	Eosinophil growth, differentiation	
	IL-6 (IFN- $\beta_2$ , BSF-2, BDNF)	184, monomer	CD126, CDw130	T cells, macrophages	T- and B-cell growth and differentiation, acute phase protein production	Decreased acute phase reaction
	IL-7	152, monomer*	CDw127, $\gamma_c$	Bone marrow stroma	Growth of pre-B cells and pre-T cells	
	IL-9	125, monomer	IL-9R, $\gamma_c$	T cells	Mast cell enhancing activity	
	IL-11	178, monomer	IL-11R, CDw130	Stromal fibroblasts	Synergistic action with IL-3 and IL-4 in hematopoiesis	
	IL-13 (P600)	132, monomer	IL-13R, $\gamma_c$	T cells	B-cell growth and differentiation, inhibits macrophage inflammatory cytokine production	
	G-CSF	? monomer*	G-CSFR	Fibroblasts	Stimulates neutrophil development	
	IL-15 (T-cell growth factor)	114, monomer	IL-15R, $\gamma_c$	T cells	IL-2-like, stimulates growth of intestinal epithelium	
	GM-CSF (granulocyte macrophage colony stimulating factor)	127, monomer*	CDw116, $\beta_c$	Macrophages, T cells	Stimulates growth and differentiation of myelomonocytic lineage	
	OSM (OM, oncostatin M)	196, monomer	OMR, CDw130	T cells, macrophages	Stimulates Kaposi sarcoma cells, inhibits melanoma growth	
	LIF (leukemia inhibitory factor)	179, monomer	LIFR, CDw130	Bone marrow stroma, fibroblasts	Maintains embryonic stem cells, like IL-6, IL-11, OSM	
Interferons	IFN- $\gamma$	143, monomer	CD119	T cells, natural killer cells	Macrophage activation, increased MHC expression	Susceptibility to intracellular infection
	IFN- $\alpha$	166, monomers	CD118	Leukocytes	Anti-viral, increased MHC class I expression	
	IFN- $\beta$	166, monomer	CD118	Fibroblasts	Anti-viral, increased MHC class I expression	
Immunoglobulin superfamily	B7.1 (CD80)	262 dimer	CD28, CTLA-4	Antigen-presenting cells	Co-stimulation of T-cell responses	
	B7.2 (B70)		CD28, CTLA-4	Antigen-presenting cells	Co-stimulation of T-cell responses	

\* May function as dimers